CONSUMER BEHAVIOR AND THE SAFETY EFFECTS OF PRODUCT SAFETY REGULATION*

W. KIP VISCUSI
Duke University

I. Introduction

A recurring issue in the economic analysis of risk regulation agencies is whether these efforts have had any significant favorable effect on safety. Although the existence of such an effect would not necessarily imply that these efforts were worthwhile, without an enhancement in safety there is no potential rationale for these regulations.

Most of the research to date has focused on auto accidents and job risks. Motor-vehicle accidents pose the chief safety risk, accounting for one-half of all accidental fatalities.[1] Studies of the safety-enhancing effects of seat belts have, however, failed to indicate any clear-cut beneficial effect of this safety measure on auto fatality rates.[2] One contributor to their ineffectiveness is that drivers will reduce the degree to which they exercise care as their safety protection from seat belts and other protective features increases, thus dampening and possibly even offsetting the safety improvements from seat belts.

The studies of job safety have placed less emphasis on the role of individual behavior, not because worker actions are unimportant, but because Occupational Safety and Health Administration (OSHA) regula-

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[1] National Safety Council, Accident Facts 13 (1982).

[2] See, in particular, Sam Peltzman, The Effects of Automobile Safety Regulation, 83 J. Pol. Econ. 677 (1975); Glenn Blomquist, The Regulation of Highway Traffic Safety (manuscript) (forthcoming, Am. Enterprise Inst.), and Robert W. Crandall & John D. Graham, Automobile Safety Regulation and Offsetting Behavior: Some New Empirical Estimates, 74 Am. Econ. Rev. 328 (1984).

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tions have not been particularly effective in altering firms' incentives to invest in safety. Noncompliance with OSHA regulations is quite frequent, in large part because the expected penalties for noncompliance are negligible and the costs that must be incurred to achieve compliance are considerable. The net effect is that there is no evidence of a significant effect on safety.[3]

The Consumer Product Safety Commission (CPSC) represents an intermediate case in terms of the level of the risks possibly affected by agency actions. Roughly 30 percent of all home accident deaths are product related, which is almost double the risk level from work accidents and just over half that of motor-vehicle accidents.[4] Although some products (for example, boats) have been specifically excluded from the CPSC's jurisdiction, the agency has broad authority over a wide range of consumer products.

This scope derives from the historical role of the CPSC, an independent regulatory commission established in 1972 (and first operating in 1973) in order to consolidate the product safety functions scattered throughout the federal government. The CPSC inherited the functions of the Federal Hazardous Substances Act (formerly administered by the Department of Health, Education, and Welfare, the Department of Commerce, and the Federal Trade Commission), the Poison Prevention Packaging Act of 1970 (formerly administered by the Department of Health, Education, and Welfare), and the Refrigerator Safety Act (formerly administered by the Department of Commerce and the Federal Trade Commission). Congress also gave the CPSC broad authority to set standards to eliminate "unreasonable" risks and to issue bans and recalls of products that violate CPSC standards or that create "a substantial risk of injury to the consumer."[5]

Notwithstanding the potential importance of the CPSC, there has been very little systematic scrutiny of its efforts. Published studies have addressed the limitations of its product safety data base and one particular standard—the mattress flammability standard—but there has been no comprehensive empirical assessment of the agency.[6] This paper is in-

[3] For a review of the role of worker actions and a general assessment of the impact of OSHA, see W. Kip Viscusi, Risk by Choice: Regulating Health and Safety in the Workplace (1983).

[4] The 30 percent figure is based on the CPSC's estimate that 30,000 consumers are killed annually using consumer products, in conjunction with data on an overall accidental death level of 99,000 in 1981.

[5] See the Consumer Product Safety Act, Pub. L. 92-573, § 2(a) and § 15(a), 86 Stat. 1207, 1221 (1972) (codified at 15 U.S.C. § 2064(a) (1982)).

[6] Two principal published studies are V. K. Broussalian, Risk Measurement and Safety

tended to provide a detailed empirical assessment of the effect of CPSC regulations on product safety.[7]

Section II begins with a review of the principal home accident data series, for which I will test whether there has been any shift in accident trends as a result of the CPSC's efforts. These aggregative statistics do not suggest any statistically significant effects, a finding that is similar to the results of analyses of other risk regulation agencies. Section III presents the principal case study—the effect of protective bottle caps on poisonings. The implications of this regulation are strongly related to consumers' behavioral response to safety caps. The strength of this behavioral response and the detailed information available regarding poisonings make this a particularly instructive case study of consumers' response to regulatory protection. A series of other CPSC regulations are reviewed in Section IV in order to ascertain whether there may be some beneficial product-specific effects that are not apparent in the aggregative data or in the poisoning trends. These data provide no evidence of any significant beneficial impacts on product safety.

II. An Overview of the Impact of the CPSC

The two principal policy mechanisms the CPSC has for influencing product safety are issuing standards and banning or recalling hazardous products. The standard-setting activities have been comparatively modest. The CPSC has issued just over twenty standards pertaining to a variety of products: lawn mowers, matchbooks, baby cribs, bicycles, and children's sleepwear. Many of its efforts have focused on banning or recalling hazardous products, in part because this policy approach does not require that the CPSC go through the rule-making process. Recent CPSC ban and recall actions have addressed a wide variety of products, including refuse bins, asbestos-containing hairdryers, roller skates, electric drills, motorcycles, scuba diving equipment, and thermostats.

In each case, the CPSC does not encounter the same types of enforcement problems as does OSHA since it can typically monitor a small number of units in a standardized product line to ascertain whether firms are in compliance. For example, a single trip to a drugstore will provide very detailed information about whether drug companies are in compliance with CPSC safety cap requirements, whereas ascertaining compliance with an OSHA chemical exposure standard will require visits to

Standards in Consumer Products, in Household Production and Consumption 491 (N. Terleckyj ed. 1976); and W. Kip Viscusi, Regulating Consumer Product Safety (1984).

[7] See Viscusi, *supra* note 6, for a more extensive and less technical assessment of CPSC that complements the material presented here.

TABLE 1
THE TEN PRODUCTS MOST INVOLVED IN INJURIES, 1981

Product Group	Injuries (in Thousands)
Stairs, steps, ramps, and landings	763
Bicycles and bicycle accessories	518
Baseball	478
Football	470
Basketball	434
Nails, carpet tacks, screws, and thumbtacks	244
Chairs, sofas, and sofa beds	236
Skating	225
Nonglass tables	225
Glass doors, windows, and panels	208

SOURCE.—U.S. Consumer Product Safety Commission, Annual Report 22 (1982).

possibly thousands of workplaces using the chemical. The general consensus, including the opinion of the CPSC, is that there is a high degree of compliance with CPSC requirements.[8]

Even if fully effective, however, the CPSC regulations may not have a major effect on safety. The scope of the CPSC actions is quite modest; OSHA, for example, has promulgated over 200 times as many standards as has the CPSC. In addition, the bulk of the product risk problem cannot be eliminated without major changes in our life-styles. Table 1 lists the ten most hazardous product groups, based on the CPSC's hospital emergency room admission data. Falls down various types of stairs and ramps head the list but are not covered by CPSC policies because of the decentralized nature of the use of this product. The CPSC could, however, establish a stair width and handrail requirement, if it chose to do so. The second leading cause of accidents—riding bicycles—is already the subject of CPSC regulations, which, except for a reflector requirement, seem to bear a tenuous relationship to bike safety. Four of the other ten riskiest "products" are also sports-related activities—baseball, football, basketball, and skating. The potential impact of any CPSC regulation on these risks is likely to be negligible. The risk of being cut by a nail or a thumbtack likewise will remain so long as such products are in use.

The three remaining product risk categories are potentially more subject to the influence of CPSC policies. The CPSC has in place flammability requirements for chairs and sofas. Similarly, glass doors and windows are at least partially regulated through architectural glazing requirements for glass doors. Finally, nonglass tables could conceivably be regulated by, for example, prohibiting the presence of sharp corners and requiring

[8] This evidence is reviewed in *id.*

TABLE 2
ACCIDENTAL DEATH RATES
(Rates per 100,000 Population)

Year	Home	Poisonings (under Five)	Fires and Burns (under Five)	Ingestions (under Five)
1935	25.2	5.4	17.9	...
1940	23.9	5.0	14.8	...
1950	19.2	2.5	8.1	6.6
1960	15.6	2.2	7.3	7.0
1970	13.2	1.3	4.8	5.2
1980	10.1	.4	4.2	2.7

SOURCE.—National Safety Council, Accident Facts (1982).

rounded edges on furniture, but no such regulation now exists and would be of questionable merit. The impact of current CPSC regulations is likely to be quite small, and even if the agency were much more active than it now is, it is doubtful whether there would be a dramatic impact on product safety.

The absence of any stark shift in product safety after the advent of the CPSC is borne out by the accident trend data in Table 2. Fatal home accident rates dropped from 13.2 per 100,000 to 10.1 per 100,000 during the 1970s, but this change appears to represent a continuation in the downward accident trend that has prevailed throughout this century. As society has become richer, safety levels of all kinds have increased because of the positive income elasticity of demand for good health. The three specific accident rate series listed—poisonings, fires and burns, and ingestions—likewise have been affected by a downward trend from increasing social wealth. Since some of these component risks are strongly related to age, each of the specific risk series is for the population under five years of age, which is a high-risk group.

The first risk series I will analyze is the overall home accident rate (HR). These statistics are based on National Center for Health Statistics accident reports. Although data have been collected by this organization on a continuous basis for over fifty years, there have been some changes over time because of periodic changes in the international classification of diseases. These changes in disease categorization primarily affect illnesses rather than accidents.[9] Previous classification periods will be cap-

[9] In particular, in the case of the ninth revision, which occurred in 1976, there was an effect of the coding system of less than 2 percent on all accidents other than those related to motor vehicles. The 1976 shift will be adjusted for explicitly using comparability ratios developed by the National Center for Health Statistics. See the National Center for Health Statistics, Estimates of Selected Comparability Ratios Based on Dual Coding of 1976 Death Certificates by the Eighth and Ninth Revisions of the International Classification of Diseases, 28 Monthly Vital Statis. Rep. (February 29, 1980).

tured through a series of dummy variables (*D*1, *D*2, *D*3, and *D*4) that take on a value of one during a particular classification period and zero otherwise.

The two time periods to be analyzed will be 1933–81 and 1949–81. The 1933 starting period was selected both to avoid the complicating influence of the depression and to have a comparable starting date for all major accident series, some of which are unavailable before that date. The 1949 starting date is for a post–World War II analysis, which may better reflect current behavior to the extent that the home accident rate relationships have not been stable over the past fifty years. I selected 1949 as the starting point since a new revision in the classification system began in that year.

The first substantive explanatory variable included was the lagged value of the home accident rate (HR_{t-1}). The linear form of the accident probability was used largely to provide greater ease in interpreting the results. To take into account the constrained nature of the dependent variable, one could use the logarithm of the accident rate as in Peltzman or the log odds of the accident rate as in Viscusi.[10] The regression results with respect to the impact of CPSC were quite robust with respect to such changes in specification.[11]

Since consumer safety will be affected not only by current products but also by the stock of existing products and their manner of use, HR_{t-1} should have a positive effect on HR_t. Lagged dependent variables play a fundamental role in most accident rate equations in the literature, and in this instance omission of the HR_{t-1} variable will generate serial correlation problems.

The second principal variable is the value of real per capita consumption (PCC). This variable is intended to capture the effect of rising consumer wealth, which should have a negative effect on accidents to the extent that rising wealth leads to a greater demand for safety. There may, however, be other effects of PCC other than a pure income effect. Increased wealth may increase the volume of consumer product purchases and the nature of the product mix. For example, it may lead to increased use of pharmaceutical products which will then increase the risk of

[10] See Peltzman, *supra* note 2; and W. Kip Viscusi, The Impact of Occupational Safety and Health Regulation, 10 Bell J. Econ. 117 (1979).

[11] Other specifications of the dependent variable included the log-odds, logarithm, and percentage change in the death risk (without a lagged dependent variable). The results were very similar. For example, the CPSC variable in the natural log specification of the analog of the equation for the entire population for 1950–81 (see Table 3) had a *t*-statistic of -1.15, which is marginally different from the value of -0.90 for the linear probability version.

poisoning to one's children. From a theoretical standpoint, the predicted sign of PCC is not clear.

The fundamental variable of interest is CPSC, which is a regulatory dummy variable that takes on a value of one during the 1973–81 period and zero otherwise. This variable is intended to capture any shift in the intercept term as a result of CPSC. Finally, the equations for the entire sample included a variable that would reflect the demographic composition, in particular, the percentage of children in the population who are under age five (%UNDER5). This group is a particularly high-risk segment of the population for poisonings, ingestions, and fire and burn deaths.

Since it is not feasible to include all the diverse factors affecting product safety, the empirical analysis focuses on what might best be viewed as a reduced form model of a complex accident-generating process. For the full sample, the equation to be estimated is

$$\begin{aligned} \mathrm{HR}_t = \alpha &+ \beta_1\mathrm{HR}_{t-1} + \beta_2\mathrm{PCC} + \beta_3\mathrm{CPSC} + \beta_4\%\mathrm{UNDER5} \\ &+ \beta_5 D1 + \beta_6 D2 + \beta_7 D3 + \beta_8 D_4 + u_t. \end{aligned} \tag{1}$$

The $D1$ and $D2$ terms are omitted for regressions over time periods in which these periods of illness classification are not relevant. The expected signs of the key variables are positive for β_1, negative or conceivably positive for β_2, negative for β_3, and positive for β_4.

Table 3 summarizes the home accident rate regression results for both time periods. For each equation, I also report the Durbin-Watson statistics.[12] Here and throughout the rest of the paper there is no firm evidence of serial correlation.

The lagged home accident rate has a consistently positive effect on accidents, as we would expect. The effect is especially pronounced during the post–World War II period. Over the past few decades, over half the value of HR_{t-1} is transmitted in the subsequent year to influence HR_t. There is consequently a strong intertemporal linkage in the accident-generating process.

Real per capita consumption has a significant negative effect on home accident rates, which suggests that the wealth effect dominates any possible increase in risk from the greater level of consumption by wealthier consumers. The importance of this time trend was not sensitive to the particular measure used. Similar results were obtained using either a simple time trend variable or real per capita income instead of PCC.

[12] Although the Durbin h-statistic is more appropriate when a lagged dependent variable is included, it has similar small sample properties. In addition, this statistic was undefined for many regressions, including all of those in Table 9.

TABLE 3
HOME ACCIDENT RATE REGRESSION RESULTS

	Coefficients and Standard Errors	
Independent Variable	1933–81	1949–81
Intercept	17.49	17.79
	(4.17)	(9.96)
HR_{t-1}	.277	.548
	(.104)	(.174)
PCC	−.003	−.002
	(.001)	(.001)
CPSC	.087	−.333
	(.684)	(.370)
%UNDER5	14.66	−53.80
	(25.53)	(41.94)
*D*1	4.26	. . .
	(1.72)	. . .
*D*2	3.90	. . .
	(1.36)	. . .
*D*3	.428	1.309
	(1.097)	(.734)
*D*4	−.631	.777
	(.825)	(.525)
R^2	.97	.97
D-W	1.85	1.97

The CPSC regulation variable is never statistically significant and never has a *t*-statistic above 0.9. In the home accident data there is no evidence of a post-CPSC downward shift in the intercept term. The largest point estimate of an impact of the CPSC is in the equation for 1949–81. Taken at face value this coefficient implies a mean effect that is almost 4 percent of the 1981 home accident rate, which would have been 9.5 deaths per 100,000 rather than 9.2 if the CPSC had not been in existence. Since we cannot reject the hypothesis that the coefficient is significantly different from zero, what this result suggests is that if there is a nonzero effect, it is likely to be small. Indeed, the upper bound of the 95 percent confidence interval suggests an impact of just under 1.0 deaths per 100,000, or less than a 10 percent reduction in the home accident rate.

The principal variables influencing consumer safety are not CPSC, but HR_{t-1} and PCC. The age composition variable (%UNDER5) and the disease classification dummy variables were not statistically significant except in the pre–World War II data (*D*1 and *D*2).

One obtains similar results in an analysis of the principal accident categories that make up the overall accident rate, as reported in Table 4. Here

TABLE 4
SUMMARY OF CPSC EFFECTS ON POISONING, BURN, AND INGESTION DEATH RATES

	COEFFICIENTS AND STANDARD ERRORS FOR CPSC VARIABLES			
	1933–81 and 1941–81 (Ingestions)		1949–81	
ACCIDENT TYPE	Entire Population	Population under Five	Entire Population	Population under Five
Poisonings	.054	.209	.191	−.054
	(.155)	(.201)	(.181)	(.107)
Burns	−.136	1.286	−.193	.171
	(.414)	(.744)	(.463)	(.467)
Ingestions	.074	.340	.052	.988
	(.082)	(.604)	(.107)	(.614)

I will focus on the three accident classes most directly affected by CPSC regulations—poisonings, fires and burns, and ingestions. In each case the equations estimated were of the same general form as equation (1). The only difference was with respect to the starting point of the CPSC dummy variable, which was adjusted so as to pertain to the regulations likely to affect that risk class.

A leading target of CPSC actions has been poisonings of children. In order to reduce these hazards, Congress passed the Poison Prevention Packaging Act of 1970. Beginning in 1972, aspirin, controlled drugs, and furniture polishes were subject to a protective packaging requirement. Additional products were added to this list in the subsequent decade.

Since these packaging requirements are among the most extensive and well known CPSC regulations, it is instructive to ascertain whether they had any effect on the poisoning death rate. The particular CPSC variable used took a value of one beginning in 1972. As the CPSC coefficients in Table 4 indicate, there was no downward shift in poisoning deaths in the 1972–81 period. Even more disturbing is that in the two cases in which the coefficients exceeded the standard errors, the effects are positive. While not statistically significant at the usual levels, these effects may be a signal of a possible positive upward shift in subcategories of poisoning rates. This possibility will be explored in Section III.

The next accident category, fire and burn deaths, has been the target of a wide variety of CPSC standards. Most of these efforts have been concerned with flammability requirements instituted in response to the Flammable Fabrics Act of 1953. The pivotal year in the CPSC's regulation of these hazards was 1975, in which it instituted regulations for carpets and rugs, children's sleepwear, and clothing textiles, and set final mattress

TABLE 5
ACTUAL AND PREDICTED FIRE-RELATED DEATHS, 1974–78

	FIRE-RELATED DEATH RATE PER 100,000		
YEAR	Actual	Predicted	Difference
1974	.65	...	...
1975	.63	.65	−.02
1976	.65	.61	.04
1977	.63	.59	.04
1978	.58	.56	.02
Average for regulated period	.62	.60	.02

SOURCE.—CPSC's NEISS data and calculations by the author.

flammability requirements (for which regulation began in 1973).[13] Some of these regulations have been major sources of controversy. The flammability requirements for children's sleepwear led to use of the flame retardant Tris, which was subsequently found to be potentially carcinogenic. The beneficial safety effects of these regulations have also come under question; Linneman, for one, was unable to find any significant effect of the CPSC mattress standard on mattress-related burns.[14]

The results on the second line of Table 4 also fail to suggest any downward shift in fire and burn deaths over the primary period for which the CPSC regulated such risks. The most pertinent results are for the population under five, where these coefficients are positive. The positive CPSC variable is only significant (at the 5 percent level, one tailed test) in the case of the 1933–81 data, a result that may be due to the inability of this equation adequately to capture the nature of more recent experience. The positive CPSC effect is much smaller in magnitude and not significantly different from zero in the more recent results, which suggests that the burn-related regulations had no significant effect.

Similar results for fire and burn deaths (BR_t) are borne out by the data gathered through the CPSC's National Electronic Injury Surveillance System (NEISS) based on reports from selected hospitals. The actual level of fire-related deaths per 100,000 persons declined somewhat from the 1974–78 period, as shown in Table 5. Using the overall NSC fire and burn death equation estimated in Table 4 for the 1950–81 period, one can calculate the predicted death-rate level by adjusting the NSC equation by the ratio of the NEISS burn rate in 1974 to the 1974 NSC burn rate to put

[13] One obtains similar results using a 1973–81 dummy variable for CPSC rather than a 1975–81 variable.

[14] Peter Linneman, The Effects of Consumer Safety Standards: The 1973 Mattress Flammability Standard, 23 J. Law & Econ. 461 (1980).

them on a comparable basis. More specifically, if we let

$$\xi = \frac{BR_{74}\ (\text{NEISS})}{BR_{74}\ (\text{NSC})},$$

the estimated level of NEISS burn rates is $\xi\widehat{BR}_t(\text{NSC})$, where $\widehat{BR}_t$ is the estimated burn rate from the burn rate analog of equation (1). Actual NEISS burn rates after the regulation average slightly above their predicted levels, but by an insignificant amount (under half the standard error of the predicted value).

The final accident category considered was ingestions of objects. The CPSC has attempted to address this risk by imposing minimum size requirements on pacifiers (1977), rattles (1978), and toys (1979). All toys intended for use by children under the age of three must be sufficiently large so as not to fit within a cylinder that is 1.25 inches in diameter and 2.25 inches high.[15] The initial year 1977 was selected as the starting point for the regulatory shift variable, but similar results were obtained using 1978 and 1979. In all cases the CPSC variable is not significantly different from zero.

In terms of overall impact, the CPSC bears many similarities to other risk regulation agencies. There is no evidence in the aggregative data of any beneficial effect on product safety. In the case of poisonings, the results suggest that there may even be a possible adverse effect. Whether or not this is the case is the focus of the next section.

III. Safety Caps and Poisonings

A. *Conceptual Foundations*

One CPSC regulation familiar to all consumers is the protective bottle cap requirements. Congress passed the Poison Prevention Packaging Act of 1970 to address the problem of accidental poisonings that primarily involved young children under the age of five. This cause of accidents had gained increasing attention throughout the 1960s, in large part because increases in the percentage of the population in this group boosted the total number of poisonings. Although the poisoning rate occasionally increased as well, the dominant long-run trend in the frequency of poisonings was in the downward direction, as the fatal poisoning rate for children under five dropped from 2.52 per million in 1950 to 2.19 per million in 1960, and to 1.32 per million in 1970.[16]

[15] C.F.R. § 1501.4 (1979).

[16] All overall poisoning rate data cited in this section are based on unpublished Poison Control Center computer printouts prepared for this study. Poisoning death data are based on unpublished National Center for Health Statistics data.

The poisoning problem, which typically involves nonfatal outcomes, had shown signs of diminishing even more rapidly than before. This improvement may be attributable in part to a series of efforts directed at reducing poisonings. In the mid-1960s firms limited the number of tablets per bottle, placed warning labels on the bottles, replaced screw caps with snap caps, and in some cases voluntarily introduced safety caps. Perhaps even more important, there was a widespread educational campaign to urge parents to limit their children's access to drugs. The regulation variable used below will not capture these influences, some of which may have been undertaken in anticipation of regulation.

These efforts were augmented by explicit government regulation beginning in 1972 when the FDA required protective bottle caps on aspirin, furniture polishes, methyl salicylate, and several controlled drugs. The scope of product coverage was subsequently expanded to include turpentine (1973), oral prescription drugs (1974), iron preparations (1977), acetaminophen (1980), and several other products. Each of these regulations is now administered by the CPSC.

These measures have aroused some controversy because individuals without children—particularly many elderly with arthritis who find the caps difficult to open—are forced to incur the inconvenience of safety caps without reaping any benefits. Although such costs (plus those of the caps themselves) may exceed any prospective benefits, one would expect that the impact on safety should be favorable if consumer behavior remains unchanged.

In practice, consumer behavior will not remain the same. In the case of seat belts, for example, Peltzman showed that added seatbelt protection diminished drivers' incentive to exercise care.[17] As indicated in the recent critical review by Blomquist, the available empirical evidence on auto safety remains consistent with this hypothesis.[18]

In a companion paper, I show that safety caps will induce a "lulling effect" on consumer behavior that comprises three components.[19] First, the presence of safety caps will diminish the expected safety gains to be achieved by decreasing parental precautions regarding drugs. As a result, parents will have less incentive to reduce children's access to drugs for much the same reason that drivers protected by seat belts have less incen-

[17] See Peltzman, *supra* note 2. In Viscusi, *supra* note 10, I generalize this result to the worker safety context using quite flexible assumptions regarding preferences and incorporating the effects of the safety improvements on the wage rate. The spirit of Peltzman's results holds in this situation as well.

[18] See Blomquist, *supra* note 2.

[19] See W. Kip Viscusi, The Lulling Effect: The Impact of Protective Bottlecaps on Aspirin and Analgesic Poisonings, 74 Am. Econ. Rev. 324 (1984).

tive to exercise care. This diminished responsibility could lead to a net reduction in the safety level after the advent of protective caps, but the conditions required for this to occur are quite stringent.[20]

A second type of influence arises because of the indivisibility of individuals' safety-related actions. Many safety precautions relating to pharmaceuticals affect a variety of products, not simply those with protective caps. Parents may choose to keep drugs in a medicine chest, a kitchen cabinet, on a bathroom shelf, in a safety-latched drawer, or in a purse. To the extent that there is a spillover effect of the diminished responsibility on other products, safety caps will increase poisoning rates for these unprotected products. The net effect on safety will continue to tend to be favorable, but the effect will be dampened by the consumer response. One cannot, however, rule out a potentially counterproductive impact.

Finally, the regulation may induce consumer misperceptions regarding the importance of precautions. Safety caps are routinely called "childproof" caps rather than "child-resistant" caps even by leading CPSC officials.[21] In addition to the misperceptions regarding the safety implications of safety caps there may be an additional source of misperceptions since safety caps will tend to reduce the size of the risk associated with any particular level of precautions. To the extent that consumers tend to ignore very-low-probability events, as some studies suggest,[22] consumers may in turn dismiss these risks as unimportant. In each case, the result will be a reduction in the degree of precautions to such a low level that the net effect of the regulation may be counterproductive.

B. *The Impact on Aspirin Poisonings*

The first major target of the protective packaging requirement was aspirin, which accounted for 8 percent of all accidental poisonings in 1972 and 17 percent of all poisonings from medicines. Manufacturers were not required to use safety caps for all aspirin sold. The FDA exempted one size from the regulation, and firms typically selected their best-selling size (a 100 tablet bottle, for example) to be free of a safety cap.

The CPSC's statistical defense of the effectiveness of its safety cap

[20] The principal condition is that for all levels of effort that lead to levels of risk above those in the pre-safety cap situation, the marginal reduction in expected poisoning costs in response to additional precautions must be sufficiently below the marginal effectiveness of precautions in the pre-safety cap situation.

[21] See, for example, the statement by Sam Zagoria, CPSC Commissioner, Washington Post, November 14, 1983, at A15.

[22] See Howard Kunreuther *et al.*, Disaster Insurance Protection: Public Policy Lessons (1978).

requirements focuses on total poisonings rather than the poisoning rate, thus ignoring the decline in the high-risk population group during the 1970s.[23] Nevertheless, even the poisoning rate trend followed the pattern one would expect from an effective regulation. The fatal poisoning rate declined from 2.6 per million children under five in 1971 to a rate of 0.6 by 1980. Similarly, overall aspirin poisonings leading to hospital emergency room treatment dropped from 5.0 to 1.7 per thousand children under the age of five.

These declines need not imply that the regulation was effective. Aspirin's share of the pain reliever market has diminished as acetaminophen products, such as Tylenol, have assumed a greater role. In addition, almost all accident trends have declined throughout this century as society has become richer.

To isolate the influence of the protective packaging requirements, I will use a regression in the same spirit as equation (1), but with some modifications. The aspirin poisoning rate for children under five ($PR5_t$) is the dependent variable, and the explanatory variables include the lagged dependent variable ($PR5_{t-1}$), real per capita (PCC), and a regulatory dummy variable (CPSC), which takes on a value of one beginning in 1972. In addition, I will include an alternative measure of regulatory effectiveness—the fraction of aspirin sold with safety caps (SAFETYCAPS)—in some of the regressions. Because of the rise of acetaminophen products in the 1970s, there was a downward shift in the trend in aspirin sales. To control for changes in the exposure to aspirin, each regression will include one of three measures: the deflated or real value per capita of aspirin sales (RSALES), total aspirin tablets produced per capita (PROD), and total aspirin tablets sold per capita (SALES).[24] In all, there were six different equations to be estimated.

Table 6 reports the death-rate results for the 1963–80 period and Table 7 reports the overall poisoning rate results for the same period. The results are consistently similar in each case. There is the expected positive lagged influence of $PR5_{t-1}$ on the current poisoning rate. Moreover, as society's

[23] See Alisone Clarke & William Walton, The Effect of Safety Packaging on Children's Aspirin Ingestions (internal report, Consumer Product Safety Comm'n 1978), and the U.S. Consumer Product Safety Commission, Poison Prevention Packaging Act, Summary Report (1983).

[24] The data shift variables (for example, D4) were omitted for the Poison Control Center data since these nonfatal-risk data are not subject to the international disease classifications. In the case of the fatal poisoning rate equations, the shift terms are not statistically significant. Sales of these drugs will be affected by the perceived risk of the product. Since there is a two-year lag in the compilation and release of CPSC accident statistics, in the absence of a major catastrophe (for example, toxic shock syndrome from tampons) the effect of the product risk on consumption is likely to be recursive rather than simultaneous.

TABLE 6

ASPIRIN POISONING DEATH RATE (under Five Years), REGRESSION RESULTS, 1963–80

INDEPENDENT VARIABLE	COEFFICIENTS AND STANDARD ERRORS					
	1	2	3	4	5	6
Intercept	16.92	9.58	9.68	17.67	9.50	9.31
	(5.65)	(4.36)	(4.28)	(5.69)	(4.38)	(4.23)
$PR5_{t-1}$	.408	.489	.450	.382	.483	.456
	(.204)	(.221)	(.249)	(.205)	(.225)	(.251)
PCC	−.003	−.002	−.003	−.003	−.002	−.002
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
CPSC	−.224	.191	.305	...	...	...
	(.524)	(.553)	(.538)	...	...	...
SAFETYCAPS	...	...	...	−.677	.100	.314
	...	...	...	(.907)	(.979)	(.938)
RSALES	−.016	...	...	−.017	...	...
	(.009)	...	...	(.008)	...	...
PROD	...	−.023	...	...	−.032	...
	...	(.101)	...	...	(.102)	...
SALES	...	...	.037	...	...	.028
	...	...	(.102)	...	...	(.103)
R^2	.96	.95	.95	.96	.95	.95
D-W	2.49	1.91	1.83	2.58	1.95	1.84

TABLE 7

ASPIRIN POISONING RATE (under Five Years), REGRESSION RESULTS, 1963–80

INDEPENDENT VARIABLE	COEFFICIENTS AND STANDARD ERRORS					
	1	2	3	4	5	6
Intercept	897.5	819.6	627.5	861.1	810.6	618.5
	(1,157.5)	(335.9)	(292.4)	(1,133.9)	(326.7)	(289.2)
$PR5_{t-1}$	.732	.734	.707	.713	.723	.694
	(.330)	(.180)	(.140)	(.322)	(.176)	(.139)
PCC	−.194	−.167	−.195	−.183	−.158	−.185
	(.176)	(.088)	(.085)	(.169)	(.084)	(.081)
CPSC	−25.3	−28.3	9.7	...	...	...
	(99.5)	(96.3)	(98.6)	...	...	...
SAFETYCAPS	...	...	...	−71.0	−78.1	−9.74
	...	...	...	(167.0)	(163.1)	(169.0)
RSALES	−.435	...	...	−.364	...	...
	(3.321)	...	...	(3.277)	...	...
PROD	...	−7.33	...	...	−7.83	...
	...	(19.35)	...	...	(19.28)	...
SALES	...	...	15.1	...	...	14.4
	...	...	(13.6)	...	...	(13.7)
R^2	.92	.92	.92	.92	.89	.92
D-W	1.65	1.63	1.87	1.66	1.66	1.87

wealth has risen, the poisoning rate has exhibited the expected decline. Except in the case of the RSALES variable, in the death-rate equation, the aspirin-use variable did not play a significant role. In that case the variable had a negative sign, which is the opposite of what one would expect. Since the tablet-based measures (PROD and SALES) fail to show a similar negative effect and appear preferable, in that they avoid the distorting effect of changes in the price level, this negative result appears to be an aberration.

The choice of the regulation variable is not consequential since there is no evidence of any significant shift in poisoning rates after the advent of the safety cap requirement. These results are also not sensitive to the aspirin-use variable that is employed. The regression results consequently offer no support for the hypothesis that CPSC safety cap regulations had a statistically significant favorable effect on poisonings.

In the case of the aspirin death results, four of the six regulation coefficients are positive. More favorable results for safety caps appear in Table 7, where the largest mean impact of the regulation is for equation (5), where the safety cap effect represents roughly 9 percent of the average home accident rate over the sample period. This impact cannot be distinguished statistically from the no effect hypothesis, and the overall magnitude of any potential impact of safety caps appears to be modest.

One possible explanation for the lack of effectiveness is that consumers may have purchased those bottle sizes that did not have safety caps so that it is conceivable that almost all poisonings were from unprotected bottles. This possibility can be ruled out on inspection of the data in Table 8 for aspirin and for aspirin and analgesics combined. Just over half of all aspirin sold was in safety cap bottles.[25] This figure did not change substantially during the 1970–78 period for which detailed poisoning data are available. In contrast, the safety cap share of poisonings rose from 40 percent in 1972 to 73 percent in 1978. Not only are safety cap bottles not risk free, but they account for a majority of all aspirin poisonings. Indeed, a disproportionate share of poisonings are linked to safety caps. This result may not imply that safety cap bottles are more risky since parents with children may buy the safety-capped containers more often than consumers not in the high-risk group. Safety cap bottles may be better matched to parents with children, but this event has not had a beneficial effect on safety.

Of particular interest is the data series on the share of open bottles involved in the poisonings. Although these data are not available for

[25] These figures were based on sales data for five leading aspirin products: Bayer aspirin, St. Joseph's aspirin for children, Bufferin, Excedrin, and Anacin.

TABLE 8
CHARACTERISTICS OF POISONING INCIDENTS

	1971	1972	1973	1974	1975	1976	1977	1978
Aspirin:								
Sold with safety caps (%)	...	53	56	59	56	56	55	52
Poisonings from safety cap bottles (%)	...	40	52	60	59	67	71	73
Open bottle share of poisonings (%)	...	41	43	44	48	46	44	49
Aspiring and analgesics:								
Poisonings from safety cap bottles (%)	...	34	44	53	54	63	67	66
Open bottle share of poisonings (%)	...	43	43	44	47	44	39	47
Total poisonings	168,930	167,270	153,670	126,520	137,010	112,860	112,840	111,420

SOURCE.—Based on unpublished Poison Control Center computer printouts and pharmaceutical industry data on aspirin sales.

bottle types (that is, for whether it was a safety cap bottle) it is noteworthy that over two-fifths of all aspirin poisonings are from open bottles. In the case of an open container, a safety cap will serve no useful function. Some open-bottle poisonings occur while the parent is administering the aspirin to the child and leaves the bottle unattended. The presence of open aspirin bottles also may be related to the difficulties consumers have in opening these protective caps. Consumers may leave the bottles open rather than grapple with caps that they find difficult to open. There is some evidence in support of this possibility since the rise in safety cap poisonings has been accompanied by an increase in the role of open bottles.

The evidence on aspirin poisonings is consistent with a lulling effect on consumer behavior. Safety cap bottles accounted for a sizable share of poisonings, and many of these bottles were left open. The net effect was that there is no evidence of a favorable impact on aspirin poisonings. If this were the full effect of the regulation, the outcome would not be greatly different from what has been observed in the seat belt case. The principal difference is that the data on the role of safety caps and open bottles enable us to address the mechanisms of influence more directly.

C. *The Effect on Analgesic Poisonings*

The distinctive feature of these safety effects is the presence of a spillover effect on analgesic poisonings. Analgesic poisonings from products such as Tylenol rose from 1.1 per 1,000 children under five to a rate of 1.5 per 1,000 in 1980. Since this upward shift may be attributable to other factors, such as increased sales, once again it is desirable to isolate such influences statistically. The variables included in the analgesic poisoning rate equations reported in Table 9 are similar to those in the aspirin regression equations. One principal difference is that the CPSC variable takes on a value of one only in 1980, the year in which the safety cap requirement was extended to acetaminophen products. The hypothesis that the lulling effect from protective bottle caps on aspirin had a spillover effect on analgesics will be captured by the dummy variable UNREG, which takes on a value of one during the 1972–79 period. If bottle caps had such a spillover effect, this variable should have a positive sign.

The overall fit of the equation is quite good, but the nonregulatory variables do not perform as well as in the aspirin equation. The lagged poisoning rate has the expected positive effect on current poisonings, but this variable is not statistically significant once the sales variables are included. The difficulty is that PR_{t-1} is strongly correlated with RSALES, PROD, and SALES. Real per capita consumption also has a positive

TABLE 9
ANALGESIC POISONING RATE (under Five Years), REGRESSION RESULTS, 1963–80

	COEFFICIENTS AND STANDARD ERRORS			
INDEPENDENT VARIABLES	1	2	3	4
Intercept	−160.6	−162.4	−146.0	−154.7
	(59.8)	(62.7)	(58.7)	(58.2)
$PR5_{t-1}$	.388	−.003	.022	−.025
	(.293)	(.356)	(.283)	(.288)
PCC	.076	.077	.069	.073
	(.025)	(.027)	(.025)	(.025)
CPSC	−2.16	−1.97	−5.73	−4.66
	(15.43)	(16.05)	(15.13)	(15.07)
UNREG	22.33	23.70	21.46	23.56
	(9.70)	(11.75)	(9.39)	(9.45)
RSALES	...	.041	...	...
	...	(.182)	...	...
PROD	...	...	2.61	...
	...	...	(1.88)	...
SALES	...	...	...	2.73
	...	...	...	(2.02)
R^2	.97	.97	.97	.97
D-W	1.84	1.86	2.10	2.00

effect, which is not what one would expect if PCC captured the wealth effect on safety alone.[26] This trend variable also may reflect any temporally related diminution in consumer responsibility toward access to such medicines.

The two central variables of interest are the regulatory variables. As in the aspirin case, the CPSC variable does not pass the usual tests of statistical significance. The magnitude of the coefficient is also not great, as it never exceeds a 5 percent drop in the mean poisoning rate over the sample period. The UNREG variable, however, reflects a powerful upward shift in the poisoning rate by almost one-fifth, which easily passes the usual tests of statistical significance. This effect is remarkably robust and is not greatly altered by the inclusion of analgesic sales variables. After the advent of protective caps on aspirin there was an upward shift in analgesic poisoning rates for children under five that cannot be explained by poisoning rate trends, changes in wealth, or increases in analgesic sales.

The absolute magnitude of the post–safety cap shift is quite substantial. These results imply that 47 percent of the increase in analgesic poisoning

[26] The PCC variable continues to have a positive sign even if the per capita sales variable is omitted from the equation.

rates between 1971 and 1980 was due to the role of UNREG. Overall, this effect represents 3,500 additional analgesic poisonings of children under five annually. As in all such assessments of the impact of risk regulation, it cannot be ascertained whether this shift arose because of safety caps or some other factor correlated with this policy and not included in the equation. One such possibility is that parents with young children shifted from aspirin to Tylenol and other acetaminophen products, thus generating a higher-risk consumer group than before. Consumer self-selection of this type should, however, lower the risk from aspirin poisonings, and no such decline was observed.

The net effect of the shifts in aspirin and analgesic poisoning rates after the advent of safety caps is adverse. The overall behavior pattern is consistent with what would occur if safety caps led to a decrease in parental caution with respect to access to drugs. Because of the indivisibility of certain types of safety precautions, there was an adverse effect on analgesic poisonings since these products were not initially covered by the safety cap requirements.

D. *Overall Effect on Poisonings*

If safety caps reduced other types of poisonings so that these adverse effects were restricted to aspirin and analgesics, one might question whether these findings were the result of some factor other than changes in consumer behavior. To explore this possibility more fully, we will analyze poisoning data for a wide variety of regulated products. These product groups are listed in Table 10. In each case, a CPSC dummy variable was created to match the particular year in which this product came under a protective packaging requirement. (These years were summarized at the start of Section III.) The UNREG variable for a product took on a value of one for all years after which part of the general product class came under regulation, before the particular product became subject to a safety cap requirement. This starting point was always 1972 since internal medicines and cleaning and polishing agents both came under regulation in that year.

The first two sets of results are for product groups. These results were based on pooled time series and cross-section regression of the general form as equation one except that category-specific intercepts for particular products within the group were included, and data shift terms were omitted because they were not pertinent to Poison Control Center data. In the case of prescription drugs, for which the total sample included 336 observations, the advent of the caps had no significant effect on the poisoning trend; but there had been an earlier increase in 1972 and 1973 as

TABLE 10

POISONING RATE REGRESSION RESULTS FOR PRODUCT GROUPS, 1968–80

PRODUCT CATEGORY	COEFFICIENTS AND STANDARD ERRORS: CPSC	UNREG
Pooled product groups:		
Prescription drugs	–.083	.987
	(.621)	(.550)
Unregulated internal medicines	. . .	35.52
	. . .	(17.07)
Single products:		
Baby aspirin	–.398	. . .
	(8.560)	. . .
Adult aspirin	.932	. . .
	(1.310)	. . .
Aspirin, unspecified	.401	. . .
	(1.210)	. . .
Analgesics	–.391	2.247
	(1.878)	(1.251)
Barbiturate sedatives	–.308	–.135
	(.238)	(.337)
Nonbarbiturate sedatives	.571	.522
	(.400)	(.345)
Internal antibiotics	1.501	2.345
	(1.105)	(.770)
Psychopharmocological agents	.350	4.154
	(3.000)	(2.849)
Iron preparations	–1.123	–.205
	(.783)	(.397)
Hormones	1.424	2.540
	(1.996)	(1.571)
Cardiovascular drugs	–.184	.076
	(.763)	(1.484)
Amphetamines	–.814	.468
	(.702)	(1.125)
Miscellaneous internal medicines	4.437	5.576
	(3.139)	(2.674)
Liquid polish or wax	4.510	. . .
	(1.729)	. . .
Turpentine	–.495	. . .
	(.596)	. . .
Solvents and thinners	.273	. . .
	(1.803)	. . .
Unregulated cleaning and polishing products	. . .	33.15
	. . .	(11.95)

reflected in the positive UNREG variable. The poisoning rate of internal medicines that were not subject to safety caps exhibited an alarming increase. These products include cough medicines and other nonprescription drugs.

The bottom portion of Table 10 presents similar results for narrowly defined product groups. In the case of aspirin, for which I found no significant CPSC effect overall, there is also no evidence of effectiveness for particular product groups such as baby aspirin. The only CPSC coefficient that passes the usual tests of statistical significance is that for liquid polish or wax, which reflected a small positive shift in the poisoning rate trend. The UNREG variables for three drugs were both positive and statistically significant: analgesics, internal antibiotics, and miscellaneous internal medicines. There was an increase in poisonings for unregulated cleaning and polishing agents of roughly the same magnitude as for unregulated internal medicines.

The general pattern is consistent with the more aggregative results. There is no evidence of a downward shift in poisonings from regulated products, but poisonings from several products escalated during the periods in which they were not covered by safety caps. Those products with significant UNREG coefficients include: analgesics, internal antibiotics, psychopharmacological agents, miscellaneous internal medicines, and unregulated cleaning and polishing agents.

The net effect was adverse. This evidence is broadly consistent with a model in which there are indivisibilities in consumers' safety precautions, so that the reduction in consumer precautions increased the risk from unprotected bottles. Diminished parental responsibility included leaving bottles uncapped. The strength of these effects suggests that there may also have been some consumer misperception regarding the effectiveness of the caps. Consumers may have dismissed the importance of the safety problem because of the false assumption that these caps were "child proof."

IV. Analysis of CPSC Risk Data

Although the safety cap requirements were not effective in promoting safety, other CPSC regulations may have had a beneficial effect that was too small to be reflected in the aggregative data analyzed in Section II. To address this possibility, I will focus on the CPSC's NEISS data, which was used in Section II with respect to fire-related accidents. The CPSC uses a sample of selected hospital emergency room admissions to generate national injury estimates for 1,000 specific product groups (for example, power sanders). Since the first complete calendar year for which such data are available is 1973, and in some cases later, this information provides insight only into recent product safety trends.

Unlike most risk data series, the NEISS data have been the object of considerable controversy.[27] The disputes have not focused on the validity of the injury numbers but on their use. The fundamental objection is that the CPSC bases its policies on trends in the total number of injuries provided through the NEISS system rather than on a use-adjusted risk level or, what is even more pertinent, on the overall merits of the regulation. This deficiency in the nature of the risk measure can be remedied by putting the risk data in per capita terms, as are other leading risk data series. In some cases I will adjust even more specifically for the extent of use by, for example, calculating the number of bicycle injuries per bicycle in use.

A second shortcoming is that narrowly defined product categories (such as stepladders) pose small-sample problems and categorization problems (for example, one can record a ladder-related accident under any one of several product-related categories, such as ladders not specified or stepladders). I will avoid each of these difficulties by analyzing only broad product groups.

I will begin with an analysis of three fire-related regulations promulgated under the Flammable Fabrics Act, which is now administered by the CPSC. Although the analysis of two data series on fire-related deaths in Section II failed to indicate any significant shift, specific product groups may have had a more favorable response. The first product safety standard I will analyze is the CPSC mattress standard, for which Linneman failed to find any evidence of a downward shift in the risk level during the 1974–77 period.[28]

The CPSC promulgated an early version of the standard in 1973 and the current version in 1975.[29] This flammability standard was performance-oriented in that it imposed, for example, maximum char length limits on mattresses exposed to a lit cigarette. The per capita death risk from mattresses and bedding dropped by 30 percent since 1974.[30] Table 11 sum-

[27] Two discussions of these shortcomings are by Broussalian, *supra* note 6, and Viscusi, *supra* note 6.

[28] See Linneman, *supra* note 14.

[29] C.F.R. § 1632 (1975).

[30] These data are more comprehensive than Linneman's, *supra* note 14, since burn and smoke-inhalation deaths are both included, whereas Linneman's data were restricted to burns only. If the mix of accidents is not changing, however, this difference should not be consequential except insofar as the sample size of mattress-related accidents is a bit larger. In the case of Linneman's study, 269 of the reported burns between 1965 and 1974 were mattress related. The CPSC mattress death data I use pertain to an average of about 200 mattress or bedding deaths annually.

TABLE 11
SUMMARY OF EFFECTS OF CPSC REGULATIONS

	Regulated Period Averages		
Risk Category	Actual	Predicted	Difference
Mattress/bedding (deaths per 100,000)	.89	1.02	−.13
Matches (injuries per 100,000)	2.98	2.91	.07
Carpets and Rugs (injuries per 100,000)	14.69	7.39	7.30
Cribs (injuries per 1,000 births)	2.81	2.66	.15
Bicycles (injuries per 1,000 bicycles in use)	7.88	6.05	1.83

SOURCE.—Calculations by the author using unpublished NEISS data and data from the Bicycle Manufacturers Association and U.S. Bureau of the Census.

marizes average actual and predicted levels of the NEISS-based measure of mattress-related death rates per 100,000 persons for the 1974–78 period for which CPSC data are available. There was a 30 percent drop in the death rate over this period, but at least some of this decline should be expected because of the general increase in safety over time.

Using the equation for the NSC fire and burn death rates from Section II and adjusting the scale appropriately,[31] we can forecast the predicted rate of mattress deaths beginning in 1975, the year of the final standard. The difference between actual and predicted mattress deaths is consistently negative, and the average difference represents about 12 percent of initial death rates. One cannot rule out the possibility that a small shift has occurred, particularly in view of the consistent negative signs involved.[32] An alternative possibility is that the causal factor is not improved mattresses but a decline in cigarette smoking by adults in the mid-1970s, which has reduced the major cause of mattress fires.[33]

The risk pattern displayed in the period after the imposition of the CPSC matchbook safety standard displays a similar downward trend. This standard required that the friction be on the outside back cover or at the bottom of the matchbook, that the matchbook remain closed without

[31] In particular, I used the fire and burn death-rate equation estimated for the 1949–81 period for the entire population using NSC data. The scale of the equation was adjusted by multiplying the predicted values by the ratio of the 1974 mattress-related death rate to the overall NSC fire and death rate.

[32] The pattern of these discrepancies was a bit uneven, with 1976 and 1978 representing the largest differences. Presumably, the effect should be steadily increasing if the CPSC standard were effective.

[33] There was a 6 percent decline in the adult smoking population from 1974 to 1979. See the U.S. Department of Commerce, Statistical Abstract of the United States, 1982–1983, at 123.

external force, and that firms undertake adequate control. One would not expect these measures to have a major effect on hospital emergency admissions for matchbook-related injuries. The post-standard decline parallels the pattern one would expect on the basis of the overall fire and burn trend and is in fact insignificantly higher than the predicted level. In addition, the rising market share of butane lighters also should have contributed to a decline in match-related risks.

The most surprising of the fire-related product risk trends is that for carpets and rugs. On December 30, 1975, the CPSC issued flammability performance criteria for carpets that were intended to reduce fire-related accidents associated with these products.[34] Although most carpet-related accidents, such as falls, do not stem from flammability risks and are not directly affected by the regulation, there is no reason a priori to believe that these accidents will be influenced adversely by the standard.

The carpet-related injury rate has doubled from its preregulation level, and the increase is more than double when compared with the trend one could have expected based on home accident rate trends. An increase in carpet sales is not the explanation, since annual sales declined in real terms over that period.[35] The principal nonfire source of carpet accidents—falls—also does not appear to be responsible, since total deaths from falls dropped by 16 percent from 1975–81.[36]

At least some of the upward shift may be due to changes in the NEISS data base. In 1978, the year in which the carpet injury rate rose by one-fourth, the CPSC changed its sample of hospitals and altered its method of risk classification.[37] The explanation only appears to account for part of the shift. A more disturbing possibility is that the nature of the carpet materials now in use may pose greater risks. Since these materials are selected in part to comply with CPSC standards, it is surprising that the CPSC has not addressed this emerging risk problem other than to note that it merits "continuing attention."[38]

The difference between actual and predicted risk levels for two well known safety-related standards also provides little evidence of CPSC's

[34] C.F.R. § 1630 (1975).

[35] See U.S. Department of Commerce, *supra* note 33, at 774–75 for nominal sales data for floor coverings, which exhibited a rise of 5 percent from 1977 to 1980. The overall inflation rate over that period was 36 percent.

[36] National Safety Council, *supra* note 1, at 84.

[37] Multiple products could now be associated with any single accident. These changes may have contributed to a substantial part of the increased hazard, but they do not explain the jump that occurred in 1977, shortly after the standard took effect, or in 1980.

[38] See the Flammable Fabrics Report included in the Consumer Product Safety Commission, Annual Report, Pt. 2 (1981).

effectiveness. Along with safety caps, the CPSC crib standard ranks as the most prominent CPSC regulation in terms of its perceived effectiveness by CPSC officials. Beginning in 1973, the CPSC required that crib bars on full-sized cribs be spaced no farther than 2⅜ inches apart.[39] This spacing requirement, which was intended to prevent babies' heads from becoming lodged between the bars, was accompanied by more questionable provisions that were tantamount to a complete crib-design standard. For example, the CPSC required that cribs be 28 ± ⅝ inches wide and 52⅜ ± ⅝ inches long.

The frequency rate I constructed for crib injuries pertained to the risk per 1,000 births, since these risks are most pertinent for very young children. The average crib injury risk during the postregulation period is about 10 percent lower than in 1973. This decline is, however, slightly less than one would expect on the basis of the home accident rate trends that were used to calculate the predicted risk level.[40]

The final CPSC standard I will consider is the CPSC bicycle standard issued in 1978.[41] Although some features of the standard, such as the reflector requirement, clearly may affect safety, this regulation also imposes meticulous design and road-test requirements that run to twenty-four pages in the Code of Federal Regulations. For example, the CPSC requires that "control cables are greater than 6.4 mm (¼ inch) in diameter and cable clamps made from material not thicker than 4.8 mm (3⁄16 inch) may be attached to the top tube." The genesis of these meticulous requirements and the bicycle standard itself can be traced to the bicycle industry's efforts to keep out cheap foreign imports that were making inroads in U.S. markets.[42]

Since bicycle use has been increasing in the past decade, ideally the risk measure should reflect this change. The variable I constructed was the number of bicycle injuries per bicycle in use. This variable does not, however, take into account increased intensity of use. This greater intensity is apparently responsible both for the increase in bicycle accident rates and an excess of actual risk levels over those predicted on the basis of home accident rate trends. If there has been any beneficial effect of the

[39] C.F.R. § 1508 (1973).

[40] More specifically, I used the overall home accident rate equation for the 1949–81 period. The only years with risk levels below those predicted were 1975 and 1976. Presumably, such negative discrepancies should have occurred in more recent years if the standard were effective since the fraction of CPSC-approved cribs in the stock of existing cribs will be rising over time.

[41] C.F.R. § 1512 (1978).

[42] See Nina Cornell, Roger Noll, & Barry Weingast, Safety Regulation in Setting National Priorities: The Next Ten Years 457–504 (H. Owen & C. Schultze eds. 1976).

CPSC standard, it is being obscured by these factors that boost injury rates.

V. Conclusion

Neither the aggregative data nor the CPSC's NEISS data on particular products provide any clearcut evidence of a significant beneficial effect on product safety from CPSC actions. If there is a beneficial effect of these regulations, then it is too small to estimate reliably. Since the CPSC's regulatory efforts address a small portion of the product safety problem and in some cases bear only a tangential relationship to product safety, this type of result accords with what one might expect.

A much more surprising result was the pattern displayed by poisoning rates after the advent of safety caps. For those products covered by safety caps, there was no downward shift in poisoning rates. This ineffectiveness appears to be attributable in part to increased parental irresponsibility, such as leaving the caps off bottles. This lulling effect in turn led to a higher level of poisonings for related products not protected by the caps.

The more general ramification of these results is that technological solutions to safety problems may induce a lulling effect on consumer behavior. The safety benefits will be muted and perhaps more than offset by the effect of the decreased efficacy of safety precautions, misperceptions regarding the risk-reducing impact of the regulation, and spillover effects of reduced precautions with other products. Although the precise contribution of the regulation cannot be distinguished from other shifts in behavior that may have occurred in the 1970s, it is clear that individual actions are an important component of the accident-generating process. Failure to take such behavior into account will result in regulations that may not have the intended effect.